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3D Neutron Diffraction

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3D Neutron Diffraction (3DND) is a new technique to study shape and orientation of the individual grains composing polycrystalline samples. 3DND enables non-destructive 3D grain mapping of mm- to cm-sized samples that is not possible using other techniques.

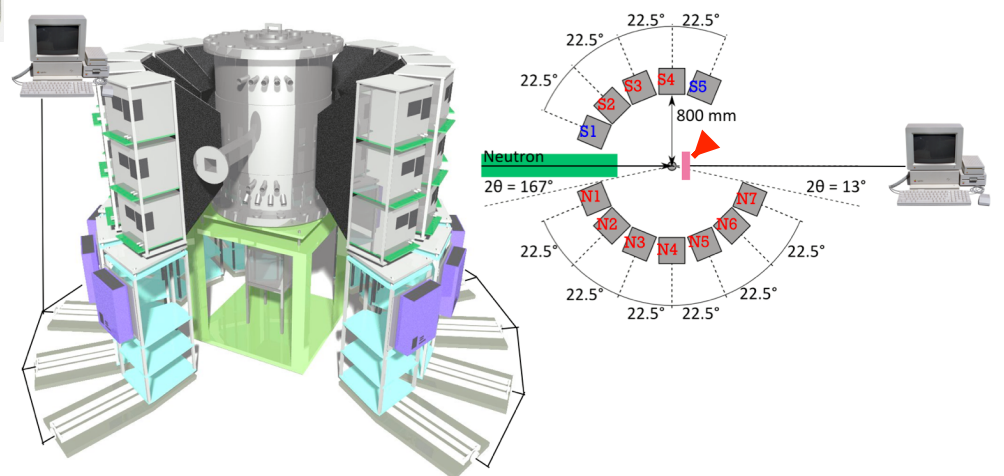
Technique	Sample size
TEM	<100nm
X-ray techniques like 3D X-ray Diff. [1]	100nm to 1mm
3DND	1mm to 1cm

We are developing the algorithms for the 3D reconstruction based on datasets collected at BL18 (J-PARC), ENGIN-X (ISIS), ICON (PSI), and virtual experiments done using McStas [2].



Time-of-flight 3DND

In June 2014 at BL18 we analysed an Armco Iron sample (99.8% purity), prepared to contain mm-sized grains. The sample was scanned over 180deg in 3deg steps, acquisition time per projection: ~ 1h.

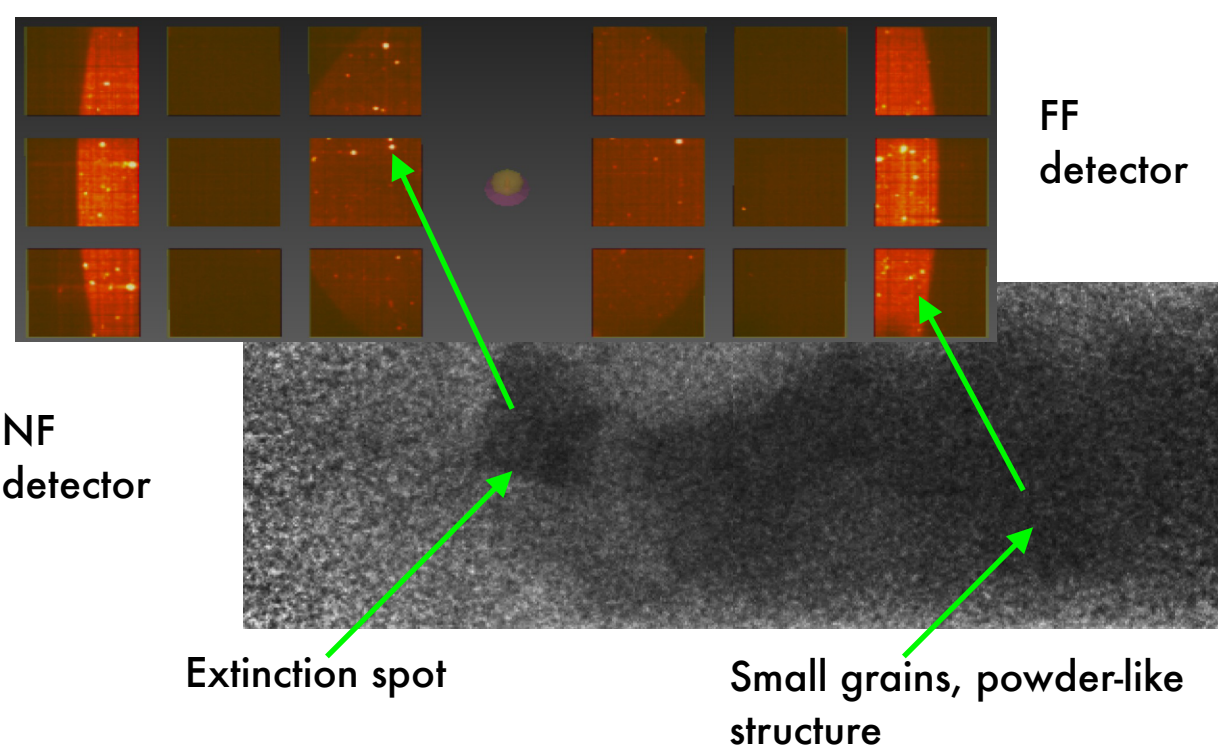
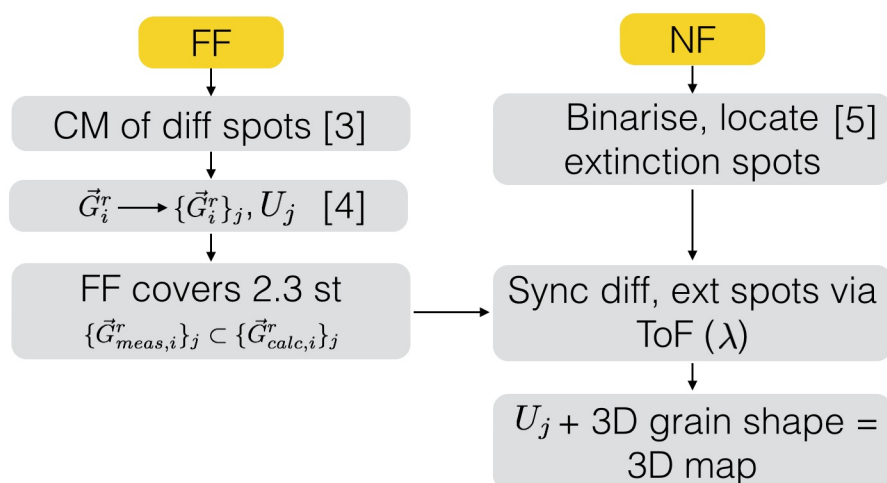


Setup used at BL18. Data were acquired simultaneously by near- (indicated by red arrow) and far-field detectors.

Near- field detector	MCP detector, $28 \times 28 \text{ mm}^2$ 1200 fr/s, pixel size $55 \mu\text{m}$ Use: shape of the grains
Far-field detectors	36 det, each $256 \times 256 \text{ mm}^2$ Pixel size 4 mm, Q: 0.6-30.7 Use: orientation of the grains

Data analysis

Data acquired simultaneously by NF and FF detectors



[1] HF Poulsen (2001). [2] K Lefmann and K Nielsen (1999). [3] T Ohhara et al (2009). [4] S Schmidt (2014).
[5] W Ludwig et al (2008)



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